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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/773,183	02/09/2004	Kia Silverbrook	MTB22US	8428

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SILVERBROOK RESEARCH PTY LTD
393 DARLING STREET
BALMAIN, 2041
AUSTRALIA

EXAMINER	
FIDLER, SHELBY LEE	
ART UNIT	**PAPER NUMBER**
2861	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/773,183	SILVERBROOK, KIA	
	Examiner	Art Unit	
	Shelby Fidler	2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 August 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6,8,10-22,24,25,27,29-44 and 46-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,8,10-22,24,25,27,29-44 and 46-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/23/07 & 9/18/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8/23/2007 has been entered.

Information Disclosure Statement

The information disclosure statements (IDS) submitted on 7/23/2007 and 9/18/2007 have been considered by the examiner.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-5, 11-13, 16, 19-22, 24, 30-32, 35, 38-42, 47-48, 50, and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 4870433) in view of Hawkins (US 4935752).

Regarding claims 1, 19, and 38:

Campbell et al. disclose an inkjet printhead comprising:

a plurality of nozzles (nozzles 19), each having a respective bubble forming chamber (print cavity 21; Fig. 2);

at least one heater element (resistive heater elements 12) disposed in each of the bubble forming chambers respectively (Fig. 2), the heater element being configured for thermal contact with a bubble forming liquid (col. 3, lines 8-11);

drive circuitry corresponding to each of the nozzles for controlling the operation of the heater element (drive circuitry is inherent to the selective energizing of heaters described in col. 1, lines 11-13 and col. 3, lines 8-11) via electrodes (electrodes 15 and 16) connected between the drive circuitry and the heater element (col. 3, lines 8-11);

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble (bubble 22) that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (col. 3, lines 8-13); wherein

part of the drive circuitry (common electrode 15) is disposed on one side of the bubble forming chamber (Figs. 1-3); and

part of the drive circuitry (individual electrode 16) is formed on the opposing side of the bubble forming chamber (Figs. 1-3), wherein

the nozzles are supplied with a replacement volume of the ejectable liquid equivalent to an ejected drop (obvious to the cyclic ejections of col. 3, lines 3-7 and col. 4, lines 64-68).

Campbell et al. do not expressly disclose that the heater element has a bubble nucleation section of a smaller cross section than the rest of the heater element so that the

temperature of the bubble nucleation section is heated to above the boiling point before the rest of the heater element.

However, Hawkins discloses heater elements (resistive material 31 of heating elements 18) that have bubble nucleation sections (high temperature/narrow section 35) of a smaller cross section than the rest of the heater element (col. 5, lines 56-59 and Fig. 4B) so that the temperature of the bubble nucleation section is heated to above the boiling point before the rest of the heater element (col. 5, line 59 - col. 6, line 4).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize heater elements with bubble nucleation sections of a smaller cross section, such as taught by Hawkins, into the invention of Campbell et al. One motivation for utilizing a heater element with a bubble nucleation section that has a smaller cross section, as taught by Hawkins, is to protect the electrode-resistive material interface by keeping the portion of resistive material adjacent the electrode at a cooler temperature (col. 5, lines 50-59).

Regarding claims 2, 20, and 39:

Campbell et al. also disclose that the heater elements (12) and bubble forming chambers (21) are symmetrical about a longitudinal plane (Figs. 1-3).

Regarding claims 3, 21, and 40:

Campbell et al. also disclose that the bubble forming chamber (21) has a circular cross section (Fig. 1) wherein the heater element (12) has at least one arcuate section (elongated portions 31) that is concentric with the longitudinal axis of the bubble forming chamber (Fig. 3) such that during use, the arcuate section forms a disc-shaped bubble (bubble 22; col. 3, lines 50-

58) with a point of collapse substantially on the central axis of the bubble forming chamber (col. 3, lines 60-64).

Regarding claims 4, 22, and 41:

Campbell et al. also discloses that the gas bubble (22) encircles at least some of the heater element (col. 3, lines 54-57 and Fig. 2).

Regarding claims 5, 24, and 42:

Campbell et al. also disclose that the bubble forming liquid and the ejectable liquid are of a common body of liquid (col. 3, lines 8-13).

Regarding claims 11, 30, and 47:

Campbell et al. also disclose that each heater element (12) has two opposite sides (e.g. top side and bottom side of Fig. 3) and is configured such that the gas bubble formed by the heater element is formed at both sides of the heater element (col. 3, lines 50-60 and Fig. 3).

Regarding claims 12, 31, and 48:

Campbell et al. also disclose that the bubble (22) is collapsible and has a point of collapse, and wherein each heater element (12) is configured such that the point of collapse is spaced from any solid surface of the heater elements (col. 3, lines 60-64).

Regarding claims 13, 32, and 50:

Campbell et al. also disclose a structure (substrate 18), wherein the nozzles (19) are incorporated on the structure (col. 3, lines 1-3 and Fig. 2).

Examiner notes the limitation that the structure is formed by chemical vapor deposition. However, this limitation pertains only to the method of forming a device, which is not germane

to the patentability of the device itself or the method of using the device; therefore, Examiner has not given this limitation patentable weight.

Regarding claims 16, 35, and 52:

Campbell et al. as modified by Hawkins disclose all claimed limitations except that the heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50.

However, Hawkins et al. disclose forming a heater element from any resistive material (col. 5, lines 29-31).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a heater element formed of Titanium Nitride (90% constituted by periodic element Titanium) into the invention of Campbell et al. as modified by Hawkins et al., since is has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Claims 6, 8, 10, 14, 25, 27, 29, 33, 43-44, 46, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Hawkins et al., as applied to claim 1 above, and further in view of Silverbrook (US 6019457).

Regarding claims 6, 25, and 43:

Campbell et al. as modified by Hawkins et al. disclose all claimed limitations except that the printhead is configured as a pagewidth printhead.

However, Silverbrook discloses a pagewidth printhead (head 200) configured to print on a page (col. 6, lines 7-12).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a pagewidth printhead into the invention of Campbell et al. as modified Hawkins et al. The motivation for doing so, as taught by Silverbrook, is to be able to print on the width of an A4 page (col. 6, lines 7-12).

Regarding claims 8, 27, and 44:

Campbell et al. as modified by Hawkins et al. disclose all claimed limitations except that the heater elements are configured such that an actuation of less than 500 nJ is required to be applied to the heater elements so as to form the bubble in the bubble forming liquid to cause the ejection of the drop.

However, Silverbrook discloses heater elements (heaters 120; Fig. 10) that are configured such that an actuation energy of less than 500 nJ is required to heat the heater element sufficiently to form the bubble in the bubble forming liquid, thereby causing an ejection of the drop (200 nJ; col. 19, lines 8-9).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize heater elements that require less than 500 nJ to heat the heater element to eject a drop into the invention of Campbell et al. as modified by Hawkins et al. The motivation for doing so, as taught by Silverbrook, is to allow power dissipation to be reduced without affecting print speed (col. 19, lines 9-10).

Regarding claims 10, 29, and 46:

Campbell et al. as modified by Hawkins et al. disclose all claimed limitations except that the substrate surface has an areal density of nozzles exceeding 10,000 nozzles per square centimeter of substrate surface.

However, Silverbrook discloses a substrate surface wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the "part of cyan" section of Figure 43, calculations show that the density exceeds 10,000 per square centimeter: $\frac{20 nozzles}{0.0016384 cm^2} = 12207 \frac{nozzles}{cm^2}$).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a printhead substrate surface with a nozzle density of 10,000 nozzles per square centimeter into the invention of Campbell et al. as modified by Hawkins et al. The motivation for doing so, as taught by Silverbrook, is to provide four nozzles per pixel which would give up to 16 drops per pixel (co. 16, lines 60-62).

Regarding claims 14, 33, and 49:

Campbell et al. as modified by Hawkins et al. disclose all the limitations of claim 1, and **Campbell et al. also disclose** a structure (substrate 18), wherein the nozzles (19) are incorporated on the structure (col. 3, lines 1-3 and Fig. 2).

Campbell et al. as modified by Hawkins et al. do not expressly disclose that the structure is less than 10 microns thick.

However, Silverbrook discloses a structure (overcoat 142) that is less than 10 microns thick (col. 9, lines 8-10), wherein nozzles are incorporated on the structure (Fig. 11).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a structure incorporating nozzles that is less than 10 microns thick into the invention of Campbell et al. as modified by Hawkins et al. The motivation for doing so, as taught by Silverbrook, is to provide increased levels of protection against the air (col. 9, lines 5-8).

Claims 15, 18, 34, 37, 51, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Hawkins et al., as applied to claim 1 above, and further in view of Kubby (US 5851412).

Regarding claims 15, 34, and 51:

Campbell et al. as modified by Hawkins et al. disclose all the limitations of claim 1, and **Campbell et al. also disclose** that the printhead comprises a plurality of bubble forming chambers (col. 2, lines 48-53) each corresponding to a respective nozzle (Fig. 2)

Campbell et al. as modified by Hawkins et al. do not expressly disclose a plurality of heater elements are disposed within each bubble forming chamber, the heater elements within each bubble forming chamber being formed on different respective layers to one another.

However, Kubby discloses a plurality of heater elements (doped regions 20) disposed within a bubble forming chamber (Figs. 4 and 5), the heater elements within each bubble forming chamber being formed on different respective layers to one another (col. 4, line 66 - col. 5, line 10).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a plurality of heater elements formed on different layers within each

bubble forming chamber, such as taught by Kubby, into the invention of Campbell et al. as modified by Hawkins et al. The motivation for doing so, as taught by Kubby, is to provide an ink jet ejector that is capable of emitting two distinct droplet sizes (col. 5, lines 11-21).

Regarding claims 18, 37, and 54:

Campbell et al. as modified by Hawkins et al. disclose all claimed limitations except that each heater element is covered on all sides with a conformal protective coating such that the coating of each heater element is seamless.

However, Kubby discloses heater elements that are covered on all sides with a conformal protective coating (protective layer of tantalum) such that the coating of each heater element is seamless (col. 4, lines 60-62 and Fig. 4).

Examiner notes the additional limitation that the coating is applied substantially to all sides of the heater element simultaneously. However, the method of forming a device is not germane to the issue of patentability of the device itself or to the method of using the device. Therefore, this limitation has not been given patentable weight.

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a seamless protective coating on all sides of the heater element, such as taught by Kubby, into the invention of Campbell et al. as modified by Hawkins et al. The motivation for doing so, as taught by Kubby, is to prevent corrosion of the semiconductor structures caused by contact with liquid ink (col. 4, lines 37-39).

Claims 17, 36, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Hawkins et al., as applied to claim 1 above, and further in view of DeMoor et al.

Regarding claims 17, 36, and 53:

Campbell et al. as modified by Hawkins et al. disclose all claimed limitations except that the heater element is configured for a mass of less than two nanograms of the solid material of the heater element to be heated to a temperature above the boiling point to heat the bubble forming liquid to a temperature above the boiling point to cause the ejection of a drop.

However, DeMoor et al. disclose using a heater element of less than 2 nanograms (page 285, Fabrication: Ti thickness = 5nm; TiN thickness = 30nm; heater width = 2000μm; heater width = 0.4μm. Therefore, the volume of Ti within the heater is $4*10^{-12}$ cm^3, and the volume of TiN within the heater is $2.4*10^{-11}$ cm^3. Using the known densities of Ti = 4.54 g/cm^3 and TiN = 5.22 g/cm^3, the heater element has an entire mass of 0.14344 ng).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a heater element of less than 2 nanograms, such as taught by DeMoor et al., into the invention of Campbell et al. as modified by Hawkins et al. The motivation for doing so, as taught by DeMoor et al., is that these types of heaters show excellent resistivity uniformity and a low TCR value (page 293, Conclusions).

Response to Arguments

Applicant's arguments with respect to claims 1, 19, and 38 have been considered but are moot in view of the new ground(s) of rejection. Please see the above obviousness-type rejection

based on the disclosures provided by Campbell et al. as modified by Hawkins et al. A logical combination Campbell et al. as modified by Hawkins et al. shows that it would have been obvious to provide drive circuitry that controls the operation of the heater element via electrodes connected between the drive circuitry and the heater element.

Communication with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Luu can be reached on (571) 272-7663. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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